

CLAIMS

We claim:

1. A method of testing a sample comprising:

a. exciting the sample with excitation radiation and thereby generating emission radiation;

5 b. varying the excitation radiation by regulating a parameter selected from the group consisting of wavelength and frequency of the excitation radiation; and

c. synchronously scanning the excitation radiation and the emission radiation to produce a spectrum,

10 wherein a constant interval between the regulated parameter of the excitation radiation and that of the emission radiation is maintained during the synchronous scanning; and

wherein the constant interval is maintained to be substantially the Stokes shift of at least one component of the sample.

2. The method of claim 1 further comprising a step of comparing the spectrum of the sample to another sample whose condition is known.

15 3. The method of claim 1 wherein the sample is selected from the group consisting of tissue and cell.

4. The method of claim 1 wherein the sample is tissue, and the method further comprises a step of comparing the ratio between the intensities at at least two wavelengths or frequencies of the spectrum of the tissue sample to that of another tissue whose condition is known, thereby determining
20 whether the tissue sample is cancerous, precancerous, or normal.

5. The method of claim 4 wherein the ratio between the intensities at at least two wavelengths or frequencies is the ratio between the intensities at wavelengths of about 290 nm and about 340 nm.

6. The method of claim 5 wherein the ratio between the intensities at wavelengths of about 290 nm and about 340 nm is higher for a cancerous tissue sample than the ratio for a normal tissue sample.

7. The method of claim 1 wherein the sample is tissue, and the method further comprises a step of comparing the peak position at at least one wavelength or frequency of the spectrum of the tissue sample to that of another tissue whose condition is known, thereby determining whether the tissue sample is cancerous, precancerous, or normal.

8. The method of claim 7 wherein the at least one wavelength is about 290 nm.

9. The method of claim 1 wherein the regulated parameter is wavelength, and the constant interval is about 40 to 145nm.

10. The method of claim 9 wherein the constant interval is about 40 to 120nm.

11. The method of claim 9 wherein the constant interval is about 50 nm.

12. The method of claim 1 wherein the regulated parameter is frequency, and the constant interval is about 5 to 500THz.

13. The method of claim 12 wherein the constant interval is about 10 to 500 THz.

14. The method of claim 12 wherein the constant interval is about 150 cm⁻¹ to 15,000 cm⁻¹.

15. The method of claim 12 wherein the constant interval is about 300 cm⁻¹ to 15,000 cm⁻¹.

16. The method of claim 3 wherein the tissue is selected from the group consisting of breast, urinary, colon, stomach, brain, prostate kidney, liver, and GYN tissue.

17. The method of claim 3 wherein the tissue comprises at least one of tryptophan, NADH, flavin and collagen.

18. The method of claim 3 wherein the sample is in a state selected from the group consisting of normal, cancer, precancer and atherosclerosis.

5 19. The method of claim 1 wherein the sample is selected from the group consisting of bacteria, virus and other biological complex.

20. The method of claim 1 wherein the wavelength of the excitation is varied in the range of 200 to 800 nm.

21. The method of claim 1 wherein spectral pass band filters are used to filter the excitation
10 radiation in the synchronous scanning step.

22. The method of claim 1 wherein a video system selected from the group consisting of photo-detector, CCD, CMOS, and avalanche diode is used to record the excitation radiation and the emission radiation in the synchronous scanning step.

23. The method of claim 22 wherein the video system is CCD.

15 24. The method of claim 1 wherein a plurality of LEDs is used to produce the excitation radiation.

25. The method of claim 1 wherein at least a portion of the excitation radiation propagates through at least one optical fiber before exciting the sample.

26. The method of claim 25 wherein the optical fiber is a component of an endoscope.

20 27. The method of claim 1 wherein at least a portion of the emission radiation propagates through at least one optical fiber before the emission radiation is scanned.

28. The method of claim 27 wherein the optical fiber is a component of an endoscope.

29. A method of testing a sample comprising:

a. exciting the sample with excitation radiation and thereby generating emission radiation;

b. varying the excitation radiation by regulating a parameter selected from the group consisting of wavelength and frequency;

5 c. synchronously scanning the excitation radiation and the emission radiation to produce a first spectrum, wherein a constant interval between the regulated parameter of the excitation radiation and that of the emission radiation is maintained during the synchronous scanning;

d. adjusting the constant interval and repeating the steps of a)-c) at least one time to produce at least a second spectrum; and

10 wherein the constant interval is maintained or adjusted to be substantially the Stokes shift of at least one component of the sample.

30. The method of claim 29 further comprising a step of comparing the spectra of the sample to those of another sample whose condition is known.

31. The method of claim 29 wherein the sample is selected from the group consisting of tissue
15 and cell.

32. The method of claim 31 wherein the tissue is selected from the group consisting of breast, urinary, colon, stomach and GYN tissue.

33. The method of claim 31 wherein the tissue comprises at least one of tryptophan, NADH, flavin and collagen.

20 34. The method of claim 31 wherein the sample tissue is in a state selected from the group consisting of normal, cancer, precancer, and atherosclerosis.

35. The method of claim 29 wherein the regulated parameter is wavelength, the wavelength of the excitation radiation is varied in the range of 200 to 800nm.

36. The method of claim 29 wherein the regulated parameter is wavelength, and the constant interval is maintained or adjusted within the range of 10-145nm.

5 37. The method of claim 29 wherein the regulated parameter is wavelength, and the change of the constant interval in the adjusting step of d) is in an increment within the range of 5-50 nm.

38. The method of claim 29 wherein the regulated parameter is frequency, and the constant interval is maintained or adjusted within the range of $\Delta\nu=5$ to 500 THz.

39. The method of claim 29 wherein the regulated parameter is frequency, and the change of
10 the constant interval in the adjusting step of d) is in an increment within the range of 5-100 THz.

40. The method of claim 29 wherein the regulated parameter is frequency, and the constant interval is maintained or adjusted within the range of $\Delta\nu=150\text{cm}^{-1}$ to $15,000\text{ cm}^{-1}$.

41. The method of claim 29 wherein the regulated parameter is frequency, and the change of the constant interval in the adjusting step of d) is in an increment within the range of 50 to 3000 cm^{-1} .

15 42. The method of claim 29 wherein spectral pass band filters are used to filter the excitation radiation in the synchronous scanning step.

43. The method of claim 29 wherein a video system selected from the group consisting of CCD, CMOS, PMT, and photodetector is used to record the excitation radiation and the emission radiation in the synchronous scanning step.

20 44. The method of claim 29 wherein a plurality of LEDs is used to produce the excitation radiation.

45. The method of claim 29 wherein at least a portion of the excitation radiation propagates through at least one optical fiber before exciting the sample.

46. The method of claim 45 wherein the optical fiber is a component of an endoscope.

47. The method of claim 29 wherein at least a portion of the emission radiation propagates
5 through at least one optical fiber before the emission radiation is scanned.

48. The method of claim 47 wherein the optical fiber is a component of an endoscope.